IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant	:	Bilyalov, Renat
Appl. No.	:	10/658,114
Filed	:	September 8, 2003
For	:	PHOTOVOLTAIC DEVICE
Examiner	:	Trinh, Thanh Truc
Group Art Unit	:	1753

DECLARATION OF JEF POORTMANS

Dear Sir:

I, Dr. Jef Poortmans, declare as follows:

I am employed by Interuniversitair Microelektronica Centrum vzw, where I hold the position of Director Solar & Organic. I received my degree in electronic engineering from the Katholieke Universiteit of Leuven, Belgium, in 1985, and have since then been working in the semiconductor electronics field.. I received my Ph.D. degree at the same University in June 1993. I authored or co-authored nearly 350 papers that have been published in Conference Proceedings and technical journals. I have written 4 book articles. I am an inventor on more than 10 patents and patent applications.

I am familiar with the present application (on which I am a co-inventor), its prosecution history, and the art of record in the application, including U.S. Patent No. 6,683,367 ("Stalmans et al."), on which I am also a co-inventor. It is my understanding that Claims 1, 3-23, 26, 37, 38, 40-42, 45, and 46 have been rejected under 35 U.S.C. § 102(e) as being unpatentable over Stalmans et al. It is also my understanding that Claims 2, 24, 25, 39, and 43-44 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Stalmans et al. in view of U.S. 5,757,024 ("Fathauer et al."); Claim 39 has been rejected under 35 U.S.C. § 103(a) as being unpatentable over Stalmans et al. in view of U.S. 5,066,340 ("Iwamoto et al."); Claims 1, 3, 4-23, 38-42, 45, and 46 have been rejected under 35 U.S.C. § 102(b) as being unpatentable over U.S. 5,331,180 ("Yamada et al."); Claims 2, 24, 25, and 43-44 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Yamada et al. in view of Fathauer et al.; and Claims

26 and 37 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Yamada et al. in view of Stalmans et al.

In response to the last Office Action, we argued that Stalmans et al. does not disclose a translucent layer. In the pending Office Action Made Final, the Examiner disagreed with this assertion, stating "[a]s seen in Figures 1(a) and 1(b), Stalmans et al. depict that the porous silicon layer can transmit light by showing an arrow (representing light) passing through the porous layer 2. Stalmans et al also describe the porous silicon layer being formed by chemical etching (See col. 8 lines 1-46). Accordingly, channels are typically formed through the unmasked areas, thereby transmitting light. It is the Examiner's position that Stalmans et al. clearly teach the limitation of the porous silicon comprising a translucent layer. It is also the Examiner's position that the structural limitations and material of making are clearly taught by Stalmans et al., thus the claimed characteristics of the structural limitation are inherent." (See Office Action mailed June 13, 2007, page 17). The assertion that Stalmans et al. inherently teaches or suggests a translucent layer is incorrect.

Stalmans et al. teaches a porous layer having a thickness of 0.1 to 1 micron (100 to 1000 nm). Stalmans et al. uses a thick porous layer to minimize transmission of light, as reflectance and diffusion are desired. The porous layer of Stalmans et al. should allow as little as possible light to pass through. Of course, one cannot avoid losing a very small part of the light through the layer, as indicated by the arrow of Figures 1(a) and 1(b).

A thicker layer as is employed in the device of Stalmans et al. is expected to give a higher reflectance, which is a desirable feature in the Stalmans et al. device. Layers with a thickness of 1-50 nm, as presently claimed, would not sufficiently reflect the light and thus would be unsuitable for use. Simulations show that a maximum of 18 % reflectance at normal incidence is observed for a 60 % porosity porous silicon layer of 50 nm thickness. For thinner layers, the reflectance is even lower, e.g., 9 % for a layer of 30 nm thickness. Reflectances of more than 70 % are typically needed for the Stalmans et al. device. Therefore, a 1-50 nm layer would not be thick enough to give sufficient light confinement for the device of Stalmans et al. In Stalmans et al., light transmission is undesirable, because the active device is on top of the porous layer, and therefore light absorption is maximized in the layer on top of the porous layer. The proposed

modification of the device of Stalmans et al. to include a porous layer as in Fathauer et al. thus renders the device unsuitable for its intended purpose.

In the invention as presently claimed, light absorption preferably occurs below the porous layer. Therefore light transmission through the porous layer in the device as presently claimed is preferably as high as possible, in contrast to the Stalmans et al. device. The comment that "channels are typically formed through the unmasked areas, thereby transmitting light", meaning that light can pass through a medium comprising pores by propagation through the pores, does not apply to the device of Stalmans et al. When the pore size is substantially lower than the wavelength (which is the case in this technology), light propagation occurs by phenomena of interference and dispersion, and therefore primarily depends on the effective index of refraction of the porous layer and its thickness, not the presence of pores themselves. The layer of Stalmans et al. with the disclosed thickness and porosity would not be considered "transparent" or of "high transparency" by one of skill in the art. Likewise, the porous layers of Yamada et al. with the disclosed thicknesses would not be considered "transparent" or of "high transparency" by one of skill in the art.

Yamada et al. concerns a light emitting device which comprises a porous layer. The thickness of this porous layer must *a priori* be as thick as possible since this would produce more light. The thickness must be such though, that charge carrier injection in the layer can efficiently be performed. The thickness disclosed in Yamada et al. is a balanced thickness which allows enough charge injection together with enough light emission. If the Yamada et al. device were to employ thinner layers, e.g., a thickness of 1-50 nm, there would be a lot less light generated, meaning a reduction in the performance of the device. The proposed modification of the device of Yamada et al. to include a porous layer as in Fathauer et al. thus renders the device unsuitable for its intended purpose.

Fathauer et al. produces light emitting devices by making a stack of alternating layers of Si and SiGe, which are then patterned into mesa structures. Thereafter, a stain etch is applied to the stack, resulting in the porisification of the SiGe layer. In col. 3, lines 25-31 of Fathauer et al., a thicker SiGe layer is linked with detrimental porosification of the silicon layers in the stack by stain etching. Stain etching is not used in preparing the Stalmans et al. device, and moreover the Stalmans et al. device does not include any silicon layers that would be detrimentally impacted

by the type of stain etching process taught in Fathauer et al. Because the 2-50 nm porous layer of Fathauer et al. would offer no benefit in the Stalmans et al. device, and would in fact be detrimental due to its thinness, one of skill in the art would not be motivated to use a porous layer as in Fathauer et al. in the device of Stalmans et al. For similar reasons, one of skill in the art would also not be motivated to combine the porous layer of Fathauer et al. with the device of Yamada et al.

I declare that all statements made herein are true, and that all statements made upon information and belief are believed to be true, and further, that these statements were made with the knowledge that willful, false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. § 1001, and that willful, false statements may jeopardize the validity of the application, or any patent issuing thereon.

Dated: 21-11-2007

Jef Poortmans

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